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University of Virginia
B.S. Mechanical Engineering
Minor: Computer Science

I combine seven years of CAD modeling experience with a deep understanding of the software, mechatronics, and engineering theory required in successful mechanical design. These skills have been honed through industry experience and academic coursework to allow me to not only create a functional design, but also to understand the critical nuances of the design that enable for its integration into our modern world.

Contents

Kinetic Art Ferrofluid Clock

Context: B.S. Mechanical Engineering Capstone Project

Skills: product development cycle + CAD + prototyping + microcontroller development + circuit design

Details: As a member of an eight person team, I built a ferrofluid clock powered by a system of actuated magnets on the backend. The clock runs off of a Parallax microcontroller and an I2C servo driver to actuate the 28 servo motors. My primary contribution to this project was the hardware and software behind the user interface. I designed the laser cut face for the control panel and integrated the LCD screen functionality. Lastly, I took ownership over the project management portion of the project by cleaning out and improving the file storage and versioning systems, setting goals for each meeting, and writing much of the final report for the project.

Kinetic Art Ferrofluid Clock

Figure 1. Clock with ferrofluid digits illuminated by LEDs below fluid tanks.

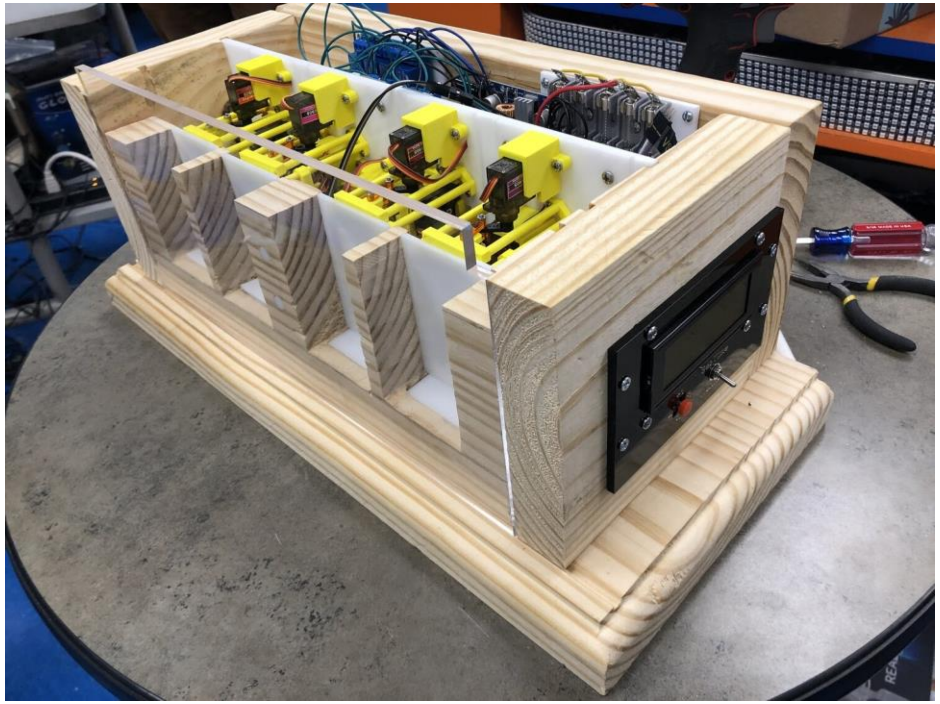

Figure 2. Clock enclosure, servo motor system, and user interface panel.

Spiral Fidget Spinner

Context: Machine Design Course Project

Skills: DFX + CAD + laser cutting + 3D printing

Details: I fully designed, modeled, and constructed this fidget spinner based on requirements given for the project. Among these requirements were bolt and bearing selection, as well as manufacturing techniques. For the CAD model, the blue components were laser cut from 0.25” acrylic and the central clamping components (in orange) were 3D printed.

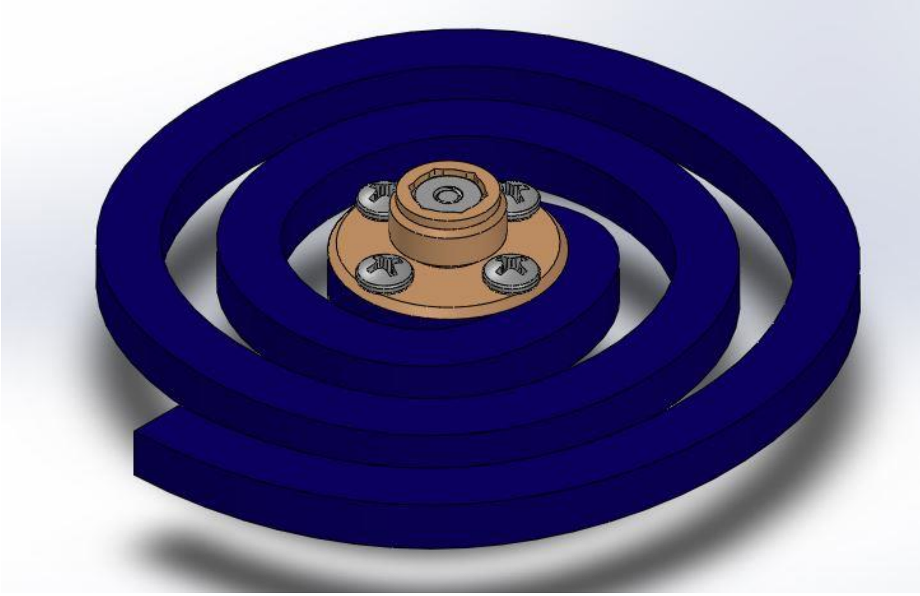

Figure 1. Full SolidWorks assembly of fidget spinner design featuring acrylic components in orange and ABS components in blue.

Spiral Fidget Spinner

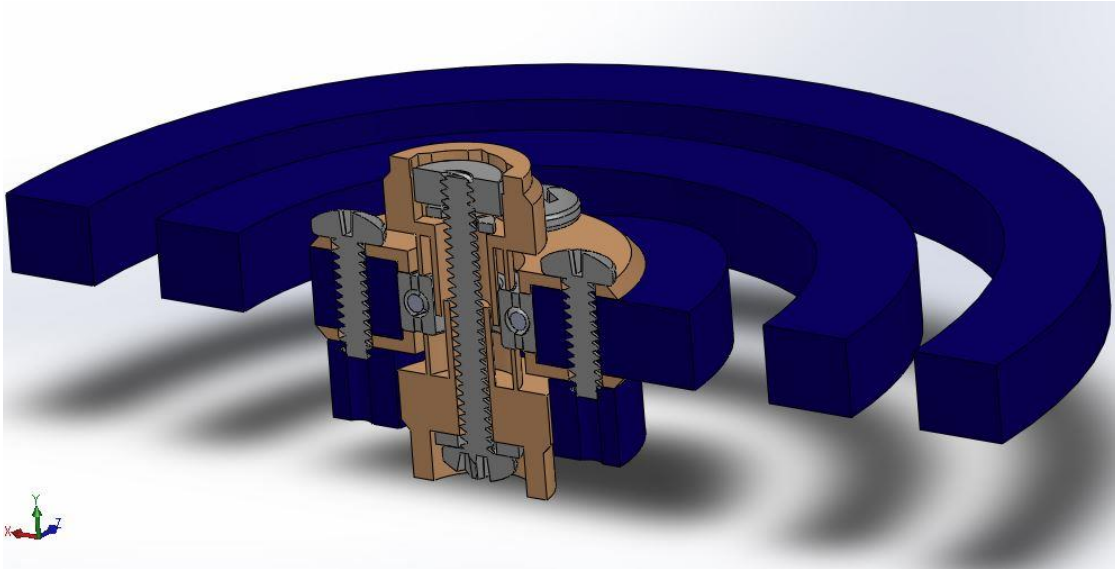

Figure 2. Section view of SolidWorks assembly displaying central bearing and 3D printed bearing clamp design.

Figure 3. Fully constructed prototype of fidget spinner based on SolidWorks models.

3D Printed Cantilever Beam

Context: Machine Design Course Project

Skills: DFX + CAD + FEA + 3D printing

Details: As a member of a group of three, we 3D printed this beam from ABS plastic with the goal to hold as much weight as possible within a 2 cu. in. volume limit and given mounting requirements. SolidWorks FEA simulations were conducted on each design iteration to estimate the load bearing capacity, deformation, and potential fracture points. The design in Figure 2 was an early model for the beam, while the design Figure 3 was the final model used by my group.

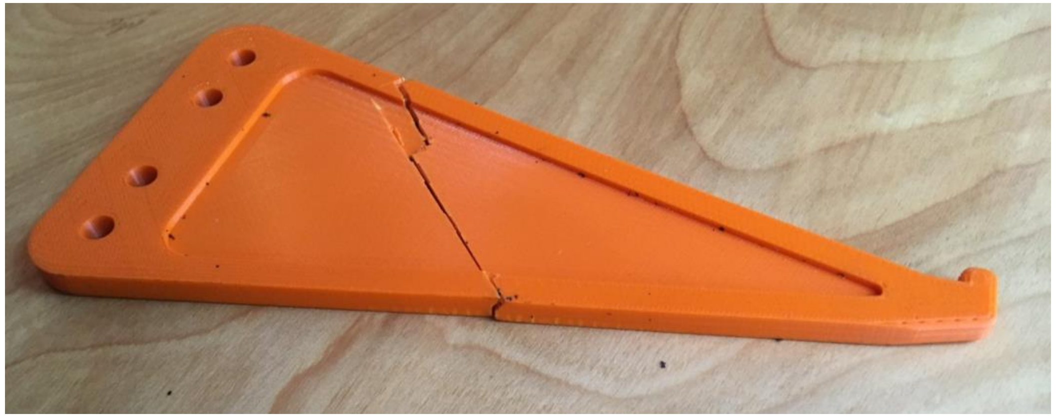

Figure 1. Final model of cantilever beam shown after testing.

3D Printed Cantilever Beam

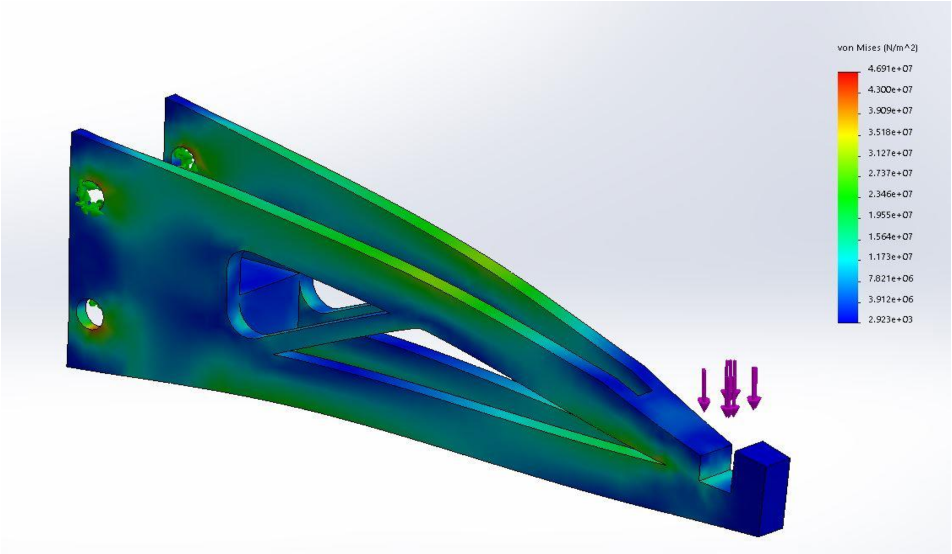

Figure 2. FEA analysis of an early beam design with a maximum von Mises stress of 4.7e7 N/m^2.

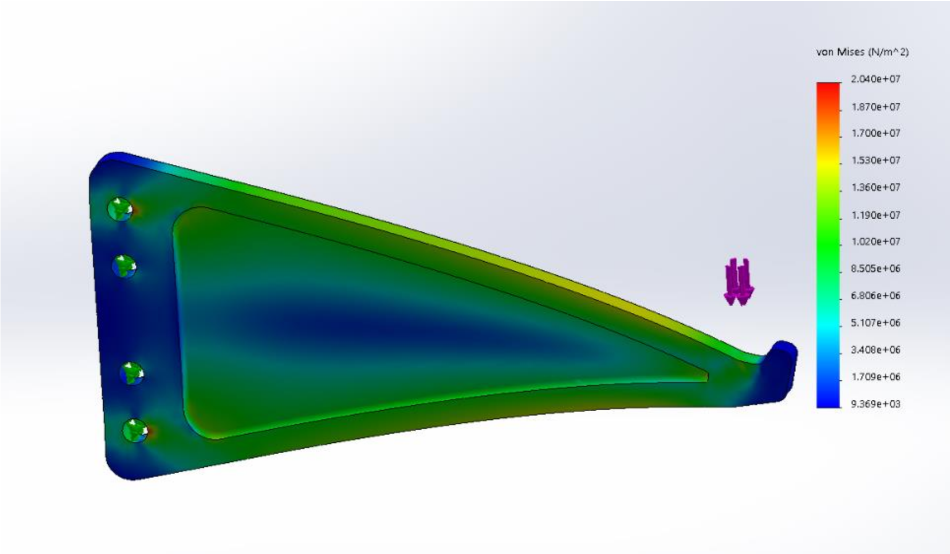

Figure 3. FEA analysis of the final beam design with a maximum von Mises stress of 2.04e7 N/m^2.

Ball Valve

Context: Personal Project

Skills: CAD + GD&T Tolerancing

Details: I developed this model as an exploration into press fit tolerancing and gap tolerancing. All joints are intended to be press fit. The gap between the ball and the pipe meets clearance fit parameters. This clearance fit does not impede proper flow or stoppage across the valve.

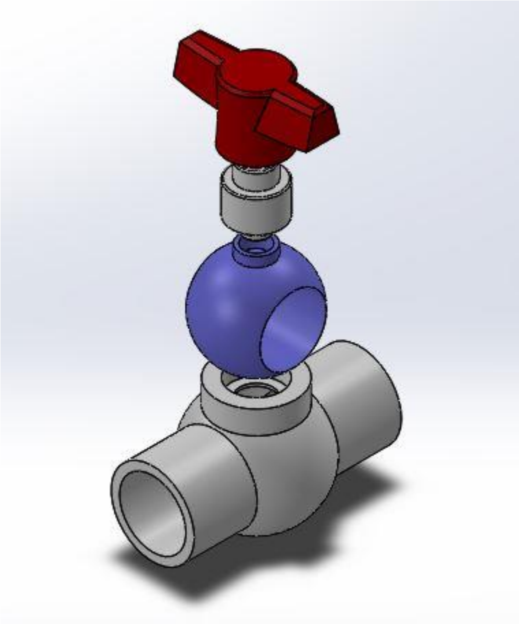

Figure 1. Full SolidWorks exploded assembly view of ball valve in closed position.

Ball Valve

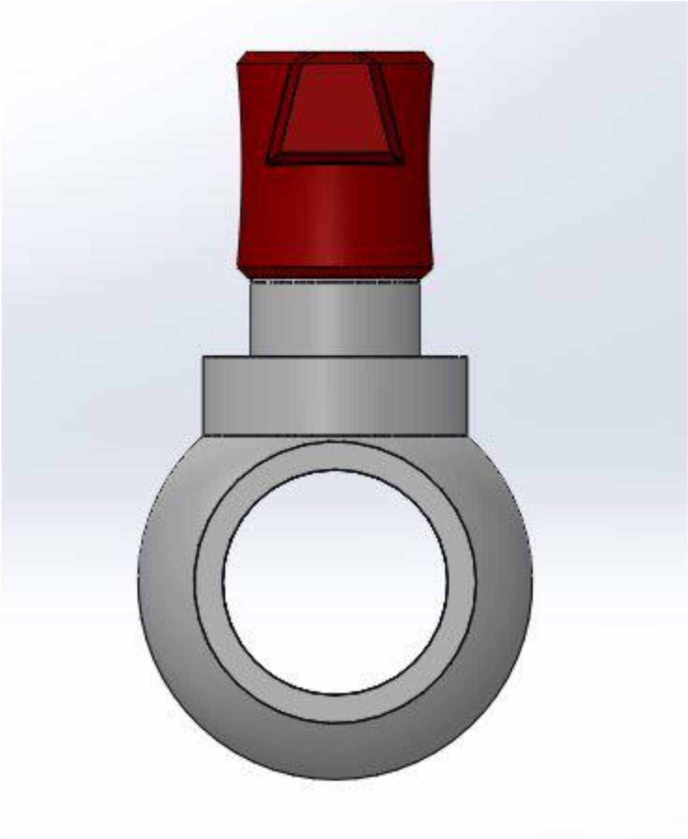

Figure 2. Full SolidWorks assembly of ball valve in open position.

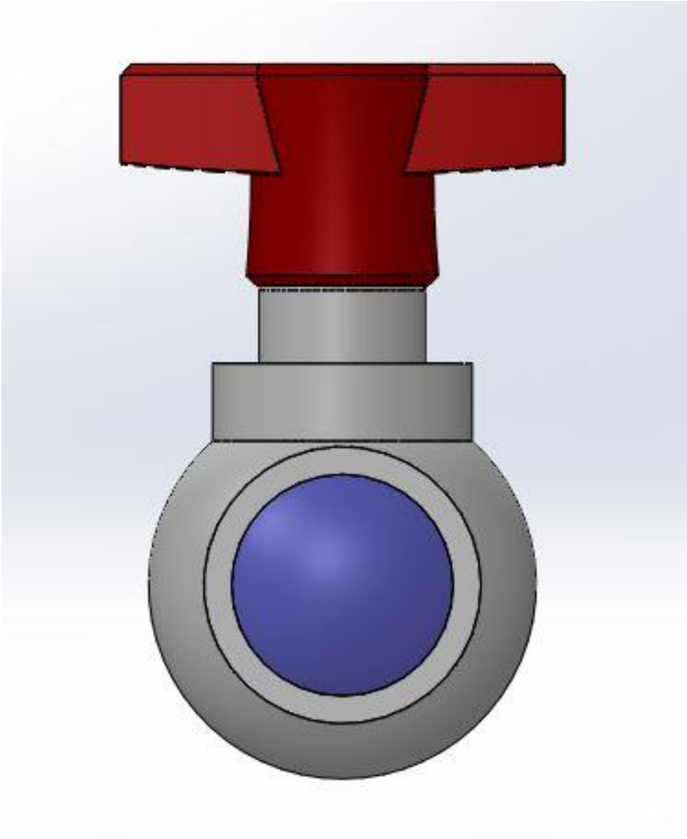

Figure 3. Full SolidWorks assembly of ball valve in closed position.

4 qt. Square Food Storage Container

Context: CAD Skills Assessment

Skills: CAD + reverse-engineering + DFM

Details: I took all dimensions for this part by hand from the physical model. This model provides an example of process and design for injection molded parts and includes proper lofts for manufacturability on all elements.

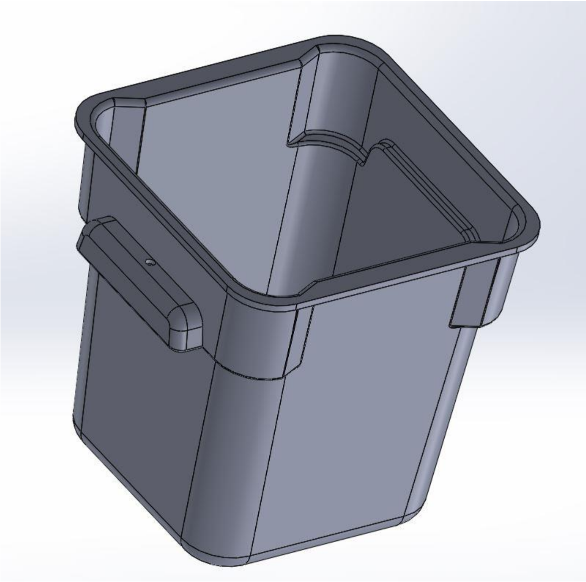

Figure 1. Top isometric view of SolidWorks model.

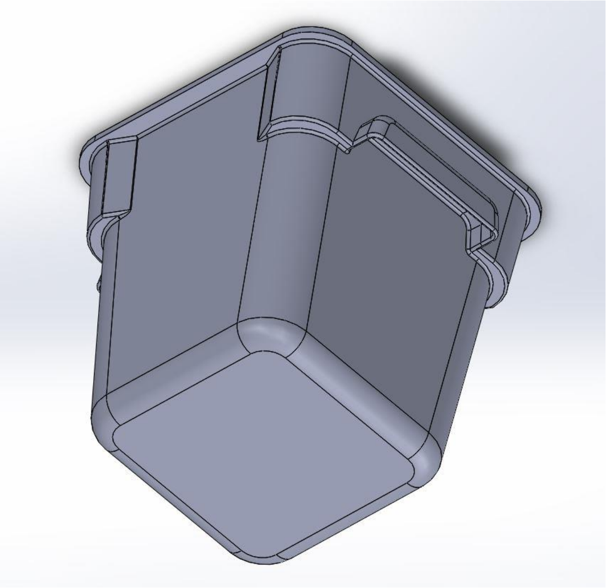

Figure 2. Bottom isometric view of SolidWorks model.

6-pack Can Holder

Context: Personal Project

Skills: CAD + reverse-engineering + DFM

Details: I developed this design by reverse-engineering the product based on the physical model as an exploration into injection molding techniques. All dimensions were taken by hand.

Figure 1. Top isometric view of SolidWorks model render.

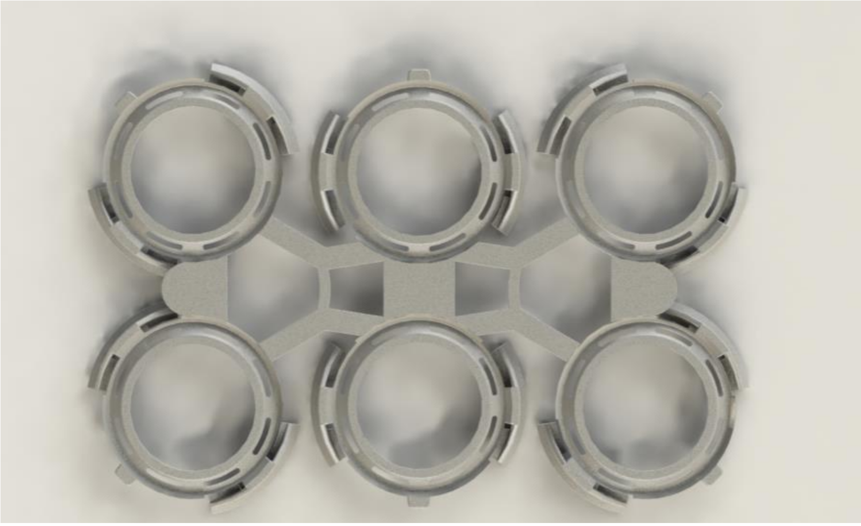

Figure 2. Top plan view of SolidWorks model render.

Machine Learning Analysis of Fish Habitats

Context: Machine Learning Course Project

Skills: Python + machine-learning + data-analysis

Details: As a team of three, we assessed human disturbances to fish habitats in Virginia based on a number of factors from a found dataset. The degradation of fish habitats is of great environmental concern. We tested five different models based on the SciKit-Learn library models, and found a Random Forest Regressor to be the most accurate. Our machine learning model used a regressor to assign a "risk score" to each habitat location. This model trained on 43,852 habitat location entries in Virginia and returned a 85% accuracy on the 4,872 locations in our testing set.

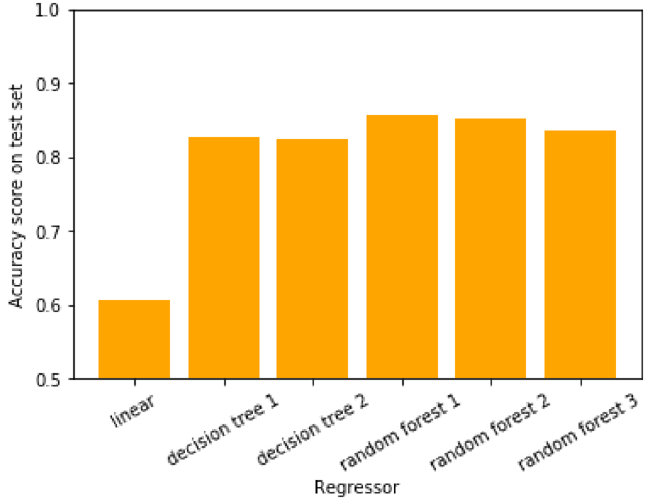

Figure 1. Comparison of model accuracy on test set for five different models with the linear regressor as a baseline.

Baseball Analytics

Context: Personal Project

Skills: Python + machine-learning + data-analysis

Details: This exploration analyzed the end-of-season rankings and statistics for every Major League Baseball team over the past ten seasons. Early analysis centered on data analysis of which teams were consistently successful this past decade, while recent work has moved toward finding a deeper understanding in team-by-team statistics through a machine learning approach. I applied a clustering algorithm to the teams to find commonalities between successful and unsuccessful teams, and I applied a regressor to estimate the team rankings and analyze feature importance.

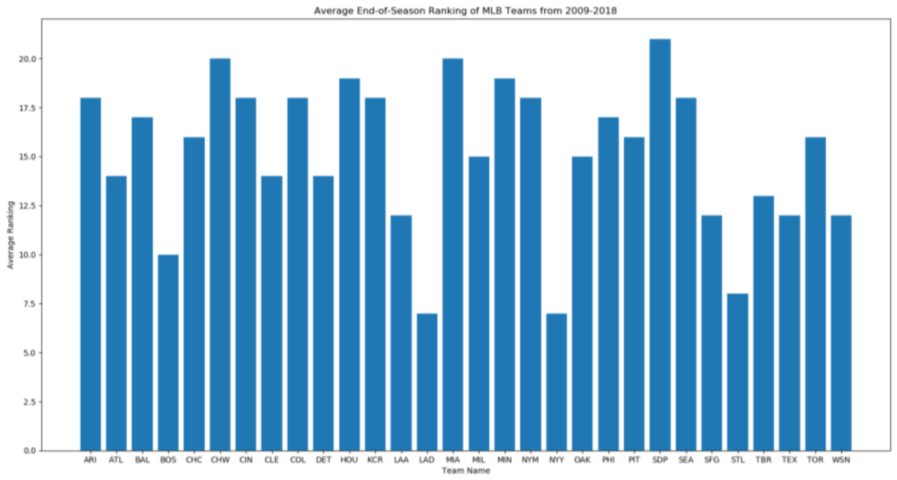

Figure 1. Average end-of-season ranking of MLB teams from 2009 to 2018.

Baseball Analytics

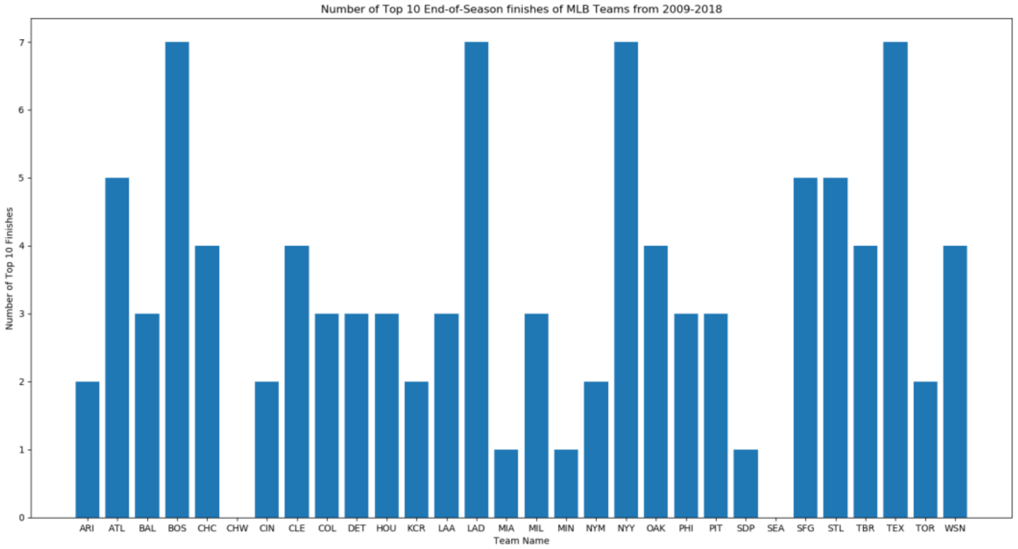

Figure 2. Number of top 10 end-of-season finishes for each MLB team over the past decade.

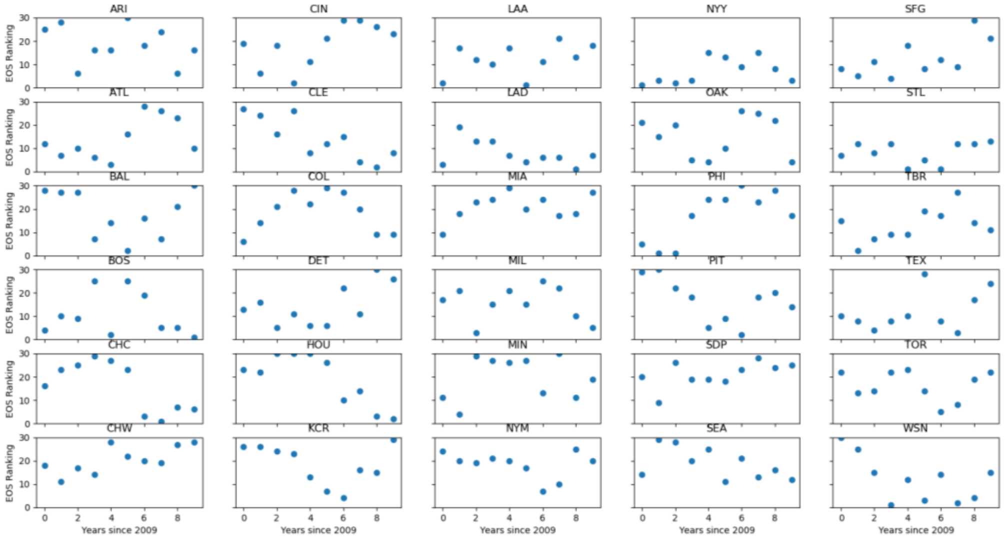

Figure 3. Season-by-season league finish for each MLB team over the past decade.